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# The Use of Cone Beam in Private Dental Practices in the United States: Cost and Reporting Patterns

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The Use of Cone Beam in Private Dental Practices in the United States:  
Cost and Reporting Patterns

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DDS, Baltimore College of Dental Surgery, 2010

A Thesis  
Submitted in Partial Fulfillment of the  
Requirements for the Degree of  
Master of Dental Science  
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**APPROVAL PAGE**

Masters of Dental Science Thesis

**The Use of Cone Beam in Private Dental Practices in the United  
States: Cost and Reporting Patterns**

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2016

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## **DISCLAIMER**

“The views expressed in this thesis are those of the author and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, nor the U.S. Government. I am a military service member (or employee of the U.S. Government). This work was prepared as part of my official duties. Title 17, USC, §105 provides that ‘Copyright protection under this title is not available for any work of the U.S. Government.’ Title 17, USC, §101 defines a U.S. Government work as a work prepared by a military service member or employee of the U.S. Government as part of that person’s official duties.”

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## **ABSTRACT**

Today in the United States (U.S.) there are over 5,000 Cone Beam Computed Tomography (CBCT) machines located in dental schools, private dental offices, and imaging centers and that number is rapidly growing.<sup>1,2</sup> These machines are estimated to acquire over 4 million scans on children, adolescents, and adults each year.<sup>2</sup> As with the advent of any new technology, law and policies generally don't keep pace with the implementation and use of the technology, and CBCT is no exception.<sup>3,4</sup> This leads to manufacturers taking the lead and marketing machines to anyone who has the means to purchase one.<sup>3</sup> In addition, practitioners are left to determine the standard of care for CBCT usage and interpretation on their own. Therefore, practice-representative data is needed to help clarify the standard of care and improve patient outcomes.

The objective of this study is to define the present use of CBCT imaging in private practice including interpretation and reimbursement trends. A self-administered survey consisting of 37 questions was created using SurveyMonkey and disseminated via email to practitioners across the U.S. One-hundred and one responses were received and used in the analysis. Whether the CBCT scan was acquired in an imaging center or private practice, implant treatment planning is the either the first or second most common indication for general dentists and most specialists. Imaging centers interpret anywhere from 15 to 60 percent of the scans acquired, almost exclusively upon request from the referring provider, and acquire on average 800 scans annually. Further, CBCT scans acquired in

imaging centers are interpreted exclusively by OMFRs. Interpretation in private practices varies from 28 to 70 percent depending on whether the scan was acquired for an external or internal patient, respectively. The credentials of the person interpreting varies much more compared to imaging centers; however, the owner or another provider within the practice are the most likely to interpret followed by an OMFR. In addition, private practices acquire on average 260 scans per year. Regardless of where the scan is acquired, the average price charged to patients is \$250. Additionally, most CBCT scans are paid for out of pocket by the patient and rarely do private insurance companies or Medicaid/Medicare contribute to the cost of the scan.

The data of this survey study demonstrates that a large number of CBCT scans are uninterpreted or interpreted without a formal radiology report added to the patient's record. In addition, this study demonstrates that often an unqualified person is interpreting the scans which can lead to an increase in patient morbidity. Unfortunately, despite the development of CDT codes for CBCT acquisition and interpretation, few insurance companies are currently reimbursing for these services.



## INTRODUCTION

The introduction of cone beam computed tomography (CBCT) into dentistry in the early 2000s dramatically changed our view of patient safety, medical-legal concerns, the cost of dentistry, and career opportunities.<sup>5</sup> Prior to the era of digital based dental imaging, including CBCT, there was a slow introduction of safety regulations; proper coding for reimbursement, proper interpretation of the vast amount of information, and the tool set available to the dental practicing community was limited. Some of these issues are still evolving today. At the time CBCT was introduced into dentistry, most Oral and Maxillofacial Radiologists (OMFR) were located in academic institutions teaching dental students the science and interpretation of dental radiography, which consisted of two-dimensional intraoral and various extraoral projections. In a 2015 study, Pakchoian and Dagdeviren et al found that OMFRs were still primarily located in academic institutions and the percentage of board certified providers is low when compared to other specialties.<sup>6</sup>

The introduction of CBCT completely transformed diagnostic dentistry as there was now a modality that provided three-dimensional data of the dentomaxillofacial region with higher spatial resolution of the hard tissues compared to multi-detector computed tomography.<sup>7</sup> However, dentists who graduated prior to the year 2000 had little to no experience using CBCT. Additionally, since its introduction, due to the crammed 4-year curriculum, most dental schools have taught CBCT on a limited basis. Upon graduation and

starting a practice, most clinicians feel pressured to buy a CBCT machine either for the ease of scanning their own patients, or to market their practice as using cutting edge technology. Part of the pressure stems from the immense amount of marketing that CBCT manufactures disseminate in the lay media which in turn leads to patient inquiries and raised expectations. In many instances, especially at conferences, manufactures put little emphasis on patient safety, cost, or interpretation of data.<sup>1</sup> Practitioners are told that they can take a brief CE course to learn the interpretation aspect, and often the manufacturer's salespeople teach the acquisition protocols and software applications.<sup>1</sup> Additionally, in states like California, non-dentists can not only own imaging centers, but can also receive certification to acquire CBCT scans after successfully completing an exam.<sup>3</sup> Last, many hospital settings that acquire three-dimensional imaging on patients for referring dentists place a disclaimer on the report, "These images were not reviewed by a radiologist for diagnostic purposes and no radiological review, report, or professional bill was generated."<sup>3</sup> This type of disclaimer removes liability from the hospital and places it back on the referring practitioner.<sup>5</sup>

We now have state-by-state radiation standards for offices with CBCT machines, patient safety campaigns such as Image Gently and Image Wisely, CDT codes recognized by the ADA and a higher awareness of the importance of interpretation of volumes by a radiologist subsequent to legal considerations.<sup>8,9</sup> However, there are still many improvements that need to happen in order to optimize the diagnostic efficacy of CBCT technology while maintaining patient safety. In most instances, insurance companies still will not reimburse for the

acquisition or interpretation of CBCTs, practitioners are using CBCT as a screening modality exposing young patients to increased doses, and many exams are not interpreted by a qualified person.<sup>10</sup> In 2013, a large step was taken when current dental terminology (CDT) codes for various aspects of CBCT including acquisition and interpretation were approved by an ADA council; however, they were clear that just having the code does not ensure insurance coverage.<sup>11</sup> Some of the burden falls on radiologists to improve in marketing themselves in the private practice realm because that is where a majority of volumes are acquired.<sup>2</sup> A CBCT exam provides clinical value only if there is a “qualified professional” to interpret the image set, and most agree that is an Oral and Maxillofacial Radiologist.<sup>12,13,14</sup> If there is not a dental school nearby, or a private radiologist who markets him or herself available to the community, then the patient image set will most likely be reviewed by the person who acquired it or not at all. The issue of lack of interpretation by a qualified person is compounded by the fact that there are approximately only 140 OMFRs practicing in the US.<sup>1</sup> This lack of quality leads to many unnecessary mistakes, in some cases leading to increased patient morbidity.<sup>15</sup>

Conventional wisdom would have it that if common sense policies such as making sure all CBCT facilities are certified, the individuals acquiring the scans are trained adequately, and all scans are accompanied by a formal report, patient outcomes can be improved. However, in order for such policies to be implemented, rigorous, practice-representative data are needed. Additionally, an understanding of the trends in practice today and how they may change

tomorrow is necessary to provide the incentive for change. These policies should not only greatly benefit our patients, which is most important, but will also likely provide new viable career opportunities for graduates and solidify OMFR as a dental specialty for years to come.

## **OBJECTIVES**

The objective of this study is to define the present use of CBCT imaging in private practice including interpretation and reimbursement trends.

## **SPECIFIC AIMS**

1. Evaluate the CBCT image acquisition patterns in private practice,
2. Evaluate the interpretation of CBCT scans in private practice,
3. Evaluate reimbursement patterns of CBCT scans in private practice, and
4. Provide data which can help develop appropriate standards of care for CBCT imaging.

## **HYPOTHESES**

CBCT machines are being inappropriately used and interpretations of the scans are infrequently associated with a formal radiological report.

Many CBCT machines are being used as a screening device and a majority of scans are paid for out-of-pocket by the patient.

Many CBCT machines are operated by someone who is not qualified.

## **MATERIALS AND METHODS**

The study received approval from the Institutional Review Board of the University of Connecticut Health Center's Human Subjects Protection Office as an exempt study. A self-administered survey consisting of 37 questions was created using SurveyMonkey (see Appendix for full survey). In addition to collecting general demographic data such as age, location of their practice, and specialty, the survey asked whether or not they own/operate a CBCT machine, how the machine is being utilized, how interpretation is handled, the level of training, and the cost and reimbursement of CBCT scans. The survey also contained multiple pathways depending on whether the practice was an imaging center or private practice and whether or not outside referrals are accepted. If outside referrals were accepted, the respondent would see duplicate questions relating to utilization, interpretation, and cost for both internal and external CBCT scans. The complete survey, when tested, took approximately three to five minutes to complete depending on whether the respondent was from an imaging center or private practice or whether they accepted outside referrals or not.

The first step in the process of creating a survey study was to acquire contacts, specifically email addresses, for practitioners known to own and/or operate a CBCT machine. The rationale for targeting this group was it would allow us to gather information specifically about the use of CBCT, albeit no information on how many CBCT units are present in the U.S. The reason for

needing to acquire email addresses specifically is because of the ease of disseminating and collecting a digital survey compared to a paper survey. We were also blind as to whether or not the practitioners had an existing relationship with an Oral and Maxillofacial Radiologist in order to gain a more accurate understanding of the interpretation patterns in the United States.

The goal of this study was to acquire contacts from multiple states in order to gain a broader picture of the CBCT usage, interpretation, and cost patterns across the United States. The FDA provided us with 690 contacts, 498 with email addresses, from California, North Carolina, and Pennsylvania, under the strict agreement that the information would only be used for educational purposes and all responses would be anonymous. This provided enough contacts to move forward with the project.

In order to maximize the numbers of completed surveys, we drafted a short letter introducing the project, explaining the objectives, and mailed a hard copy to 498 contacts in May 2015. The survey was then disseminated ten separate times from July to October 2015 at which time the survey was closed. After the initial email was sent, 63 emails were electronically returned without having been received and 54 recipients elected not to participate, leaving a total of 381 eligible respondents.

After sending out the survey several times, we decided to explore other options in order to obtain more contacts. I personally contacted 75 dentists with whom I graduated from dental school and sent the survey link to 27 of them. In addition, we contacted several CBCT manufacturers, but only one agreed to

disseminate the survey. When we closed the survey in late October, we had received a total of 107 responses.

From these 107 responses, six responses were deleted because the respondents chose “No” for question one, “Do you own and operate a CBCT machine?” and also left the rest of the survey blank. There were three remaining respondents who chose “No” for question one, however, these responses were not deleted because those respondents completed the rest of the survey. It was assumed that these three respondents read the question to literally mean “own” and “operate” a CBCT machine. Two respondents answered question thirty-four, “What is the approximate total patient cost, in dollars, of a CBCT scan in your facility?” with 3000 and 2500. We interpreted these responses as typographic errors as they were as much as 10 times higher than any other response, and subsequently changed them to 300 and 250, respectively, as these are common charges for CBCT examinations.



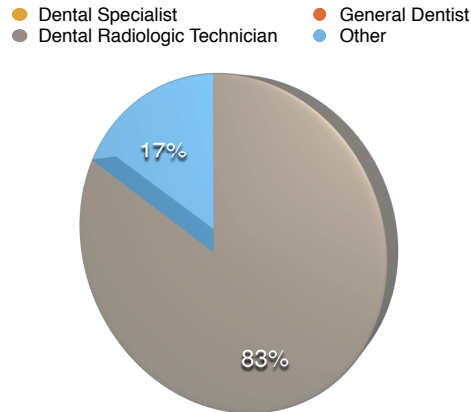
## RESULTS

One-hundred and one responses were used in the final analysis. The questions in the survey were broken down into three major categories: acquisition and utilization patterns, interpretation patterns, and reimbursement patterns.

### Imaging Center

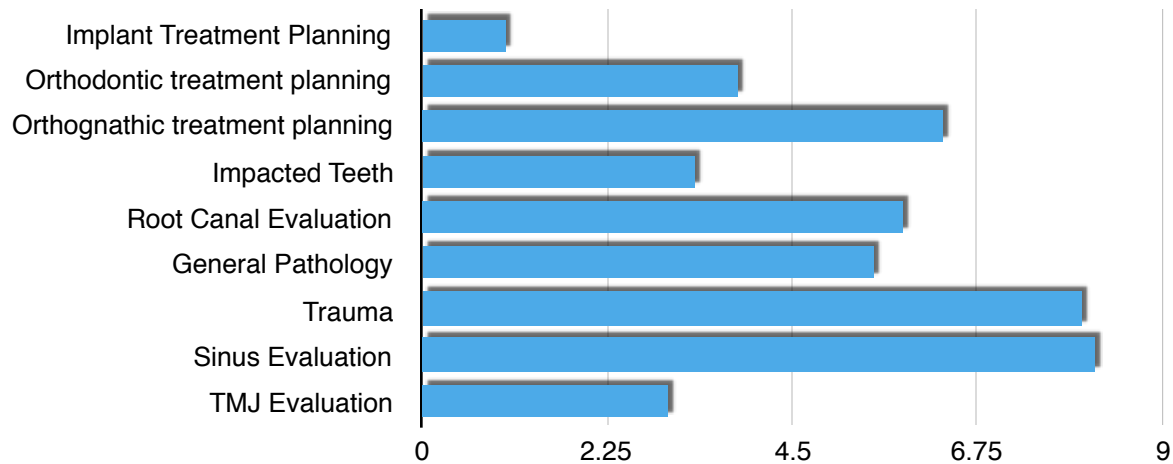
Questions three through 12 were only viewed by those respondents who chose “imaging center” on question two, “...what type of facility is the CBCT machine in?” Six respondents indicated that they work in an imaging center by answering question two “...What type of facility is the CBCT machine in?” In addition, one respondent chose other and typed in that they are located in a university. Five out of the six respondents, or 83%, indicated on question three, asking about credentials, that they were Dental Radiologic Technicians and one respondent chose “other” and typed in “Oral and Maxillofacial Radiologist” (Figure 1). This respondent is the same as the one that indicated they were located in a university.

**Figure 1.** *What are the credentials of the owner of the imaging center?*



When asked about the number of scans acquired annually on question five, all six respondents answered the question. The number of scans ranged from 280 to 1400 with a mean of 807 and a median of 780. The respondents were then asked on question six to rank from one to nine different indications for the scans being acquired in their imaging center. All six respondents answered the question and indicated that implant treatment followed by TMJ evaluation and impacted teeth were the top three most common indications for scans in their imaging center (Figure 2). Figure 2 depicts the ranked CBCT scan indications in imaging centers and the shorter the bar the more common the indication.

**Figure 2.** Please rank these CBCT indications from most to least common, for CBCT scans acquired in the imaging center.



Questions seven through twelve addressed interpretation patterns of imaging centers. All six respondents answered question seven, “How is interpretation of the scans acquired in your imaging center handled?” Five out of the six respondents, or 83%, indicated that scans were interpreted upon request by the referring provider, and one respondent indicated that all scans acquired are interpreted. The same five respondents that indicated scans are interpreted upon request answered question eight, “If scans are interpreted upon request, what percentage?” The percentage interpreted ranged from 15 to 60 percent with a mean of 33 and both a median and mode of 20. All six respondents indicated that the reports were indeed added to the patients’ records.

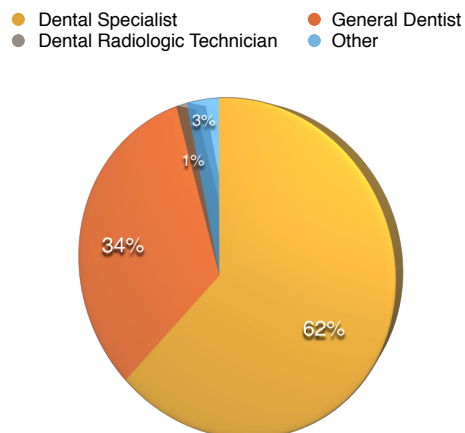
The last three questions in this category address the credentials of the person who is interpreting the scans acquired in the imaging centers. Question ten directly asks who is interpreting the scans and all six respondents indicated that when a scan is interpreted, it is done by an OMFR. Based on this result, none of the respondents saw question eleven. The respondents were then asked the affiliation of the OMFR and five respondents indicated the OMFR was

from a private reading service while one respondent chose dental school. The respondent who chose “dental school” is the same respondent who wrote in “university” for question two, “oral and maxillofacial radiologist” for question three, and that all scans are interpreted on question seven.

### Private Practice

Ninety-five out of 101, or 94%, of respondents indicated on question two that they work in a private dental office. All 95 respondents were then skipped to question 13, “What are the credentials of the owner of the practice?” and 94 answered (Figure 3).

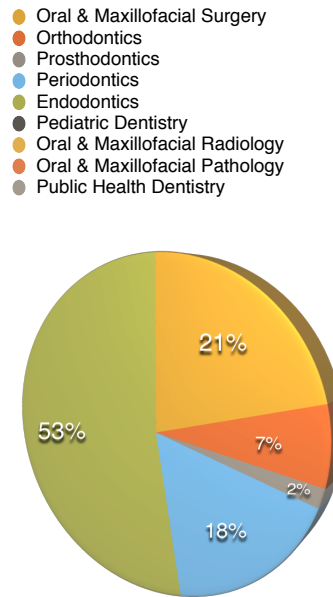
**Figure 3.** *What are the credentials of the owner of the practice?*



Fifty-eight, or 62%, chose “dental specialist,” 32, or 34%, chose “general dentist,” one chose “dental radiologic technician”, and three chose “other” (Figure 3). The respondents who chose other wrote: “oral surgeon,” “general, limited to Endo,” and “general dentist and specialist.” Those 58 respondents who chose “dental specialist” on question 13 were then asked on question 14 to indicate which specialty. Fifty-seven, or 98%, answered question fourteen. Twelve, or 21%,

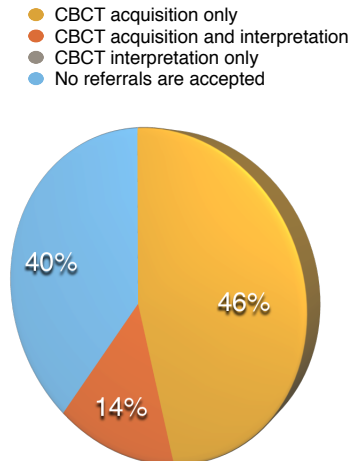
chose oral and maxillofacial surgery (OMFS), four, or 7%, chose orthodontics, one chose prosthodontics, 10, or 18%, chose periodontics, and 30, or 53%, chose endodontics (Figure 4).

**Figure 4.** *If a specialist, which specialty?*



The private practitioners were then asked to indicate how many scans are acquired in their practice annually and 91 out of 95, or 96%, responded. The number of scans ranged from 20 to 1000 with a mean of 264 and a median and mode of 200. The following question, number 16, divided the private practitioners into two groups: those who accept outside referrals and those who do not. Forty-two, or 46%, indicated they accept referrals for acquisition only, 13, or 14%, indicated they accept referrals for acquisition and interpretation, and 36, or 40%, indicated they do not accept referrals (Figure 5).

**Figure 5.** *Do you accept referrals from outside providers?*



#### CBCT scans acquired for referring providers

Fifty-one out of the fifty-five respondents who indicated on question 16 that they accept some form of referral, answered question 17 which asked for the indications for outside referrals. The indications that were ranked either number one or two were analyzed for general dentists, oral and maxillofacial surgery, periodontics, endodontics, and orthodontics. For general dentists, implant treatment planning was by far the most common indication at 38% followed by root canal evaluation, impacted teeth, TMJ evaluation, general pathology, and orthodontics (Table 1). Similarly, OMFS indicated that implant treatment planning was the most common at 41% followed by general pathology, root canal evaluation, impacted teeth, orthodontics, and finally sinus evaluation (Table 1). Again, periodontics chose implant treatment planning as the most common indication at 33%; however, general pathology and sinus evaluation were close seconds and impacted teeth and TMJ evaluation were tied for third (Table 1). Endodontics, not surprisingly, indicated that root canal evaluation was the most common at 46% followed by implant treatment planning, trauma, and sinus

**Table 1.** The top 2 indications for CBCT scans acquired for referring providers broken down by specialty. Each box represents the percent of that specialty who ranked that indication either 1 or 2.

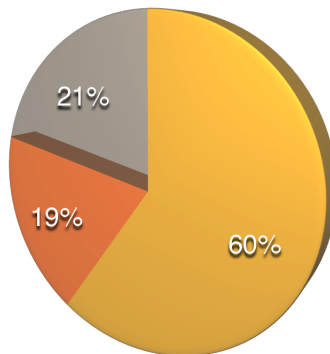
CBCT Acquisition Patterns for External Patients in Private Practice					
	General Dentist	OMFS	Perio	Endo	Ortho
Dental Implants	37.5%	41.2%	33.3%	23%	25%
Orthodontics	3.1%	11.8%			12.5%
Orthognathic					
Impacted teeth	12.5%	11.8%	8.3%		25%
Root Canal	18.8%	11.8%		46.2%	12.5%
General Pathology	6.25%	17.6%	25%	7.7%	
Trauma				19%	
Sinus Evaluation	9.4%	5.9%	25%	3.8%	
TMJ Evaluation	12.5%		8.3%		25%

evaluation (Table 1). Finally, orthodontics indicated that implant treatment planning, impacted teeth, and TMJ evaluation are equally common at 25% each followed by orthodontic treatment planning and root canal evaluation (Table 1).

Questions 18 through 24 are related to the interpretation patterns of scans acquired for referring providers. Fifty-one out of fifty-five, or 93%, answered question 18, “What percent of the CBCT scans taken for referring providers are interpreted?” The responses ranged from zero to 100% with a mean of 28%, median of 5%, and mode of zero. Additionally, for scans interpreted other than zero percent, the average is 47%, with a median of 30 and a mode of 100. Question 19 followed up by asking specifically, “When a scan is evaluated for external providers, is the entire scan evaluated or just the area of interest? Forty-eight out of fifty-five, or 87% responded and 60% indicated the entire scan is evaluated while 9% said only the area of interest is evaluated (Figure 6).

**Figure 6.** *When a scan is evaluated for external providers, is the entire scan evaluated or just the area of interest?*

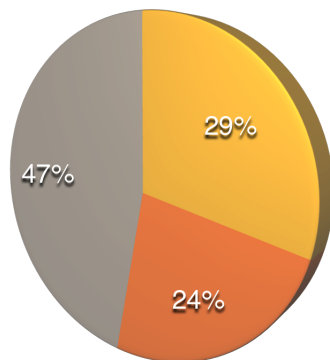
● Entire Scan ● Area of Interest ● Unknown



On question 20, the respondents were then asked if they generate a formal radiology report and add it to the patient's dental record. Twenty-nine percent chose "yes," 24% chose "no," and 47% indicated that it was the responsibility of the referring provider (Figure 7).

**Figure 7.** *Is a radiologic report generated and added to the patient's record for CBCT scans of patients referred from outside providers?*

● Yes ● No ● Responsibility of referring provider/unknown

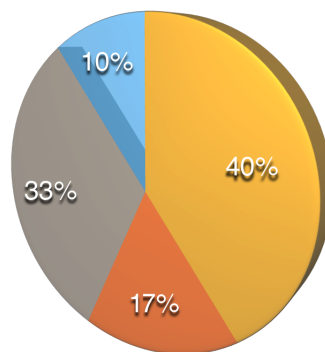




Question 21 asked, in the event a scan is interpreted, who is doing the interpreting and 95% answered the question. A majority, 40% indicated that the owner or another provider within the practice was interpreting, 17% stated that the interpretations were done by an outside dental practitioner, and 33% by an OMFR (Figure 8).

**Figure 8.** *When external scans are interpreted, who is interpreting the scan?*

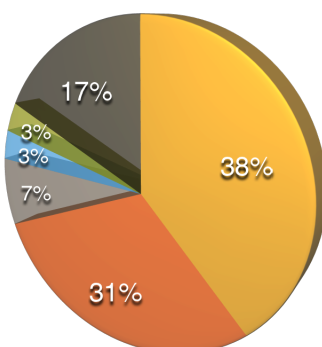
- Owner of the practice or another provider within the practice
- Outside Dental Practitioner
- Oral and Maxillofacial Radiologist
- Unknown



If the respondents indicated on question 21 that either the owner or an outside practitioner was interpreting their scans they saw question 22, and 97% responded. Eleven, or 38%, indicated they had training from the manufacturer, nine, or 31%, chose generic continuing education (CE) course, only three respondents, or 10%, chose either American Academy of Oral and Maxillofacial Radiology (AAOMR) level 1 or level 2 courses, one had no specific training, and five, or 17% chose unknown (Figure 9). Three out of five, or 60%, of the respondents who chose “unknown” on question 22, also chose “outside dental practitioner” on question 21. Respondents who chose OMFR on question 21 were skipped to question 23, “What is the OMFR’s affiliation?” and 100%

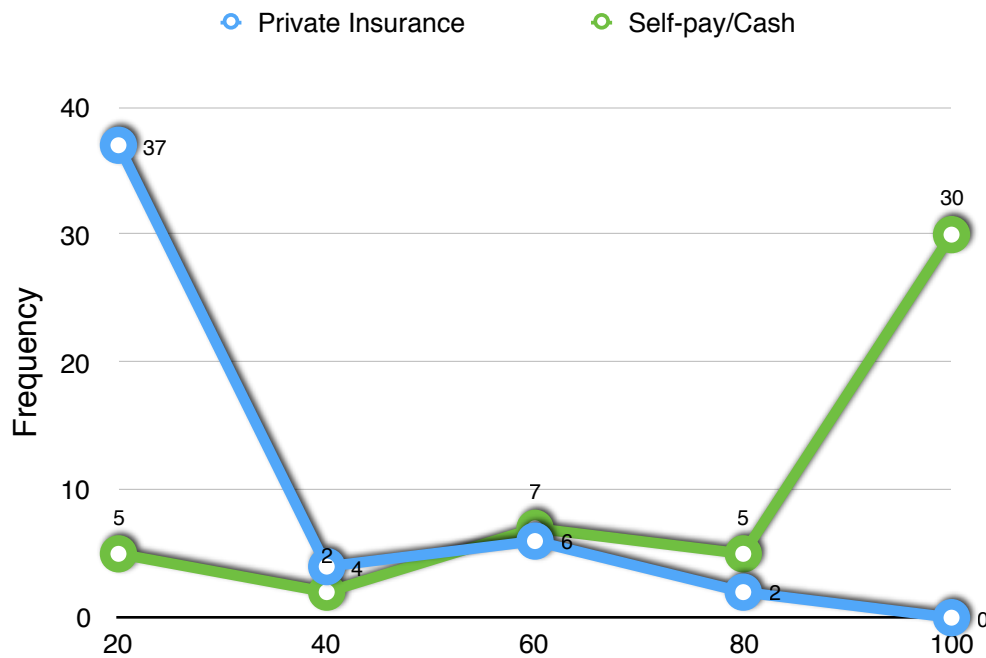
**Figure 9.** *What is the highest level of CBCT training the individual interpreting external scans has received?*

● Training from Manufacturer    ● Generic CE course  
● AAOMR - Level 1    ● AAOMR - Level 2  
● No specific training    ● Unknown



responded. Twelve, or 71%, chose “private reading service” and five, or 30% chose “dental school.” The respondents who saw question 22 were then skipped to question 24, “Approximately how many hours of training?” and 37% responded. The hours ranged from 2 to 20 with a mean of 10, median of 8, and mode of 8. The final question pertaining to external CBCT scans asked the respondents to indicate what percent of patients pay with each type of payment for scans referred from outside providers. Forty-nine out of fifty-five, or 89%, answered the question. A large majority, 30 respondents, indicated that greater than 81% of patient’s referred from outside providers paid with cash and the remaining 19 respondents were scattered throughout the rest of the percentages (Figure 10). The “private insurance” category was complementary to “self-pay/cash” with a large majority, 37 respondents, indicating that 0%-20% of patient’s referred from outside providers paid with private insurance (Figure 10). Again, the remaining 14 respondents were scattered throughout the rest of the ranges of percentages with only two indicating that more than 81% of referred patients pay for scans with private insurance (Figure 10). There were only four responses in

**Figure 10.** Please indicate what percent of patients pay with each payment type for external referrals.



the “other” box, two indicated 100%, and two indicated 10%. Only one person put 100% in the “unknown” box.

#### CBCT scans acquired for internal patients

Questions 26 through 33 are identical questions to 17 through 24; however, they are specific for internal patients.

All 36 respondents who indicated on question 16 that they do not accept outside referrals were skipped directly to question 26. In addition, the respondents who indicated that they do accept referrals were eventually taken to question 26 after answering all the questions pertaining to external referrals.

On question 26, respondents were asked to rank indications for scans taken on internal patients, and 81 out of 95, or 85%, responded. The indications were analyzed the same as question 17. Again, for general dentists, implant

treatment planning was by far the most common indication at 44%, followed by impacted teeth and root canal evaluation rounding out the top three (Table 2). For OMFS, implant treatment planning and impacted teeth were equal at 41% each followed by a much smaller percent for the rest of the indications (Table 2). Implant treatment planning was also the most common for periodontics at 50% followed by general pathology and sinus evaluation rounding out the top three (Table 2). Endodontics, not surprisingly, was concerned mainly with root canal evaluation at 49% followed by trauma at 26% (Table 2). Last, orthodontics chose orthodontic treatment planning at the most common at 50% followed by impacted teeth at 38% and TMJ evaluation at 13% (Table 2).

Questions 27 through 33 pertain to interpretation patterns of scans acquired in private practices on internal patients. Question 27 asked for the percent of scans interpreted for internal patients and 81 out of 95, or 85%, answered the question. The responses ranged from zero to 100% with a mean of 70%, and a median and mode of 100%. The following question asked “When a scan taken for internal patients is evaluated, is the entire scan evaluated or just the area of interest? Sixty-two, or 77%, chose “entire scan” and 19, or 24% chose “area of interest.” The respondents were then asked whether or not they generated a formal radiology report and added it to the patient’s record for scans acquired on internal patients. Eighty-four percent responded, with 64% indicating they do indeed add a report to the patient’s record and 36% stating that they do not.

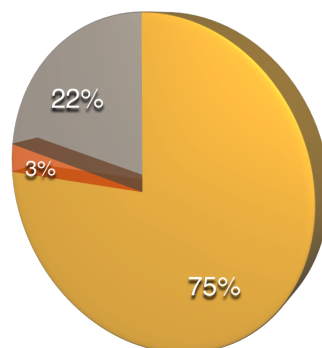
**Table 2.** The top 2 indications for CBCT scans acquired for internal patients broken down by specialty. Each box represents the percent of that specialty who ranked that indication either 1 or 2.

CBCT Acquisition Patterns for Internal Patients in Private Practice					
	General Dentist	OMFS	Perio	Endo	Ortho
Dental Implants	44%	41%	50%	9.8%	
Orthodontics	3.7%	4.5%		2%	50%
Orthognathic					
Impacted teeth	18.5%	41%		3.9%	37.5%
Root Canal	16.7%	4.5%	10%	49%	
General Pathology	9.3%	4.5%	20%	2%	
Trauma	1.9%		5%	25.5%	
Sinus Evaluation	1.9%	4.5%	15%	5.9%	
TMJ Evaluation	3.7%			2%	12.5%

Questions 30 through 33 are directly related to the credentials of the person interpreting the scans acquired on internal patients. Eighty-five percent of the private practitioners answered the question when asked who is interpreting the scans acquired on internal patients. Seventy-five percent indicated that the owner of the practice or another provider within the practice interpreted, three percent chose outside dental practitioner, and 22% chose OMFR (Figure 11).

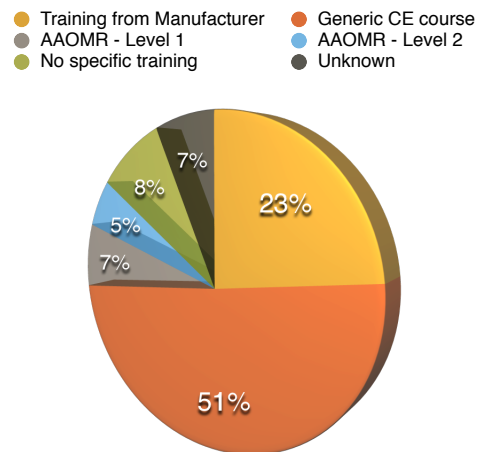
**Figure 11.** When internal scans are interpreted, who is interpreting the scan?

- Owner of the practice or another provider within the practice
- Outside Dental Practitioner
- Oral and Maxillofacial Radiologist



Once it was determined who was interpreting the scans, the survey delved further to determine that person's level of training. Those respondents who chose either choice other than OMFR on question 30 moved on to question 31, and 97% answered. Twenty-three percent, indicated they had training from the manufacturer, 51% chose generic CE course, only seven respondents or 12% chose either AAOMR level 1 or level 2 courses, 8% had no specific training, and 7% chose unknown (Figure 12).

**Figure 12.** *What is the highest level of CBCT training the individual interpreting has received?*



If respondents instead chose OMFR on question 30 they were skipped to question 32 and 100% answered. On question 32, 67% stated that the OMFR interpreting their scans was affiliated with a private reading service while 28% chose dental school and only one respondent or 6% chose unknown. The respondents who saw question 31 were skipped to question 33; however, only 22% answered the question when asked how many hours of training the person interpreting had received. The number of hours ranged from 2 to 20 with a mean of 12, median of 12, and mode of 20.

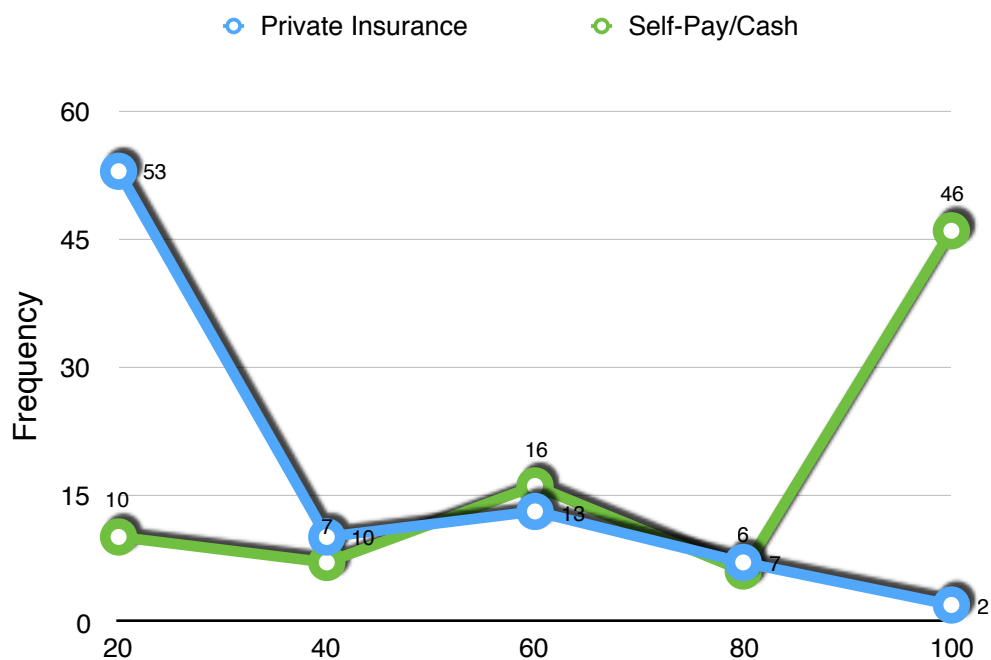
### All Respondents

All respondents saw the last four questions, numbers 34 through 37 which are related to cost and demographics. Question 34 asked “What is the approximate total patient cost, in dollars, of a CBCT scan in your facility?” and 80% answered. The cost ranged from zero to \$450 with a mean of \$247 for those who charged more than zero, and a median and mode of 250. Question 35 asked the respondents to indicate what percent of internal patients pay with each type of payment for CBCT scans. Eighty-five out of 101, or 84%, answered the question. A large majority, 46 respondents, indicated that greater than 81% of internal patients paid with cash and the remaining 43 respondents were scattered throughout the remaining percentages (Figure 13). Again, the “private insurance” category was complimentary to “self-pay/cash” with a large majority, 53 respondents, indicating that 0%-20% of internal patients paid with private insurance (Figure 13). The remaining 34 respondents were scattered throughout the rest of the ranges of percentages with only nine respondents indicating that more than 80% of internal patients paid for scans with private insurance (Figure 13).

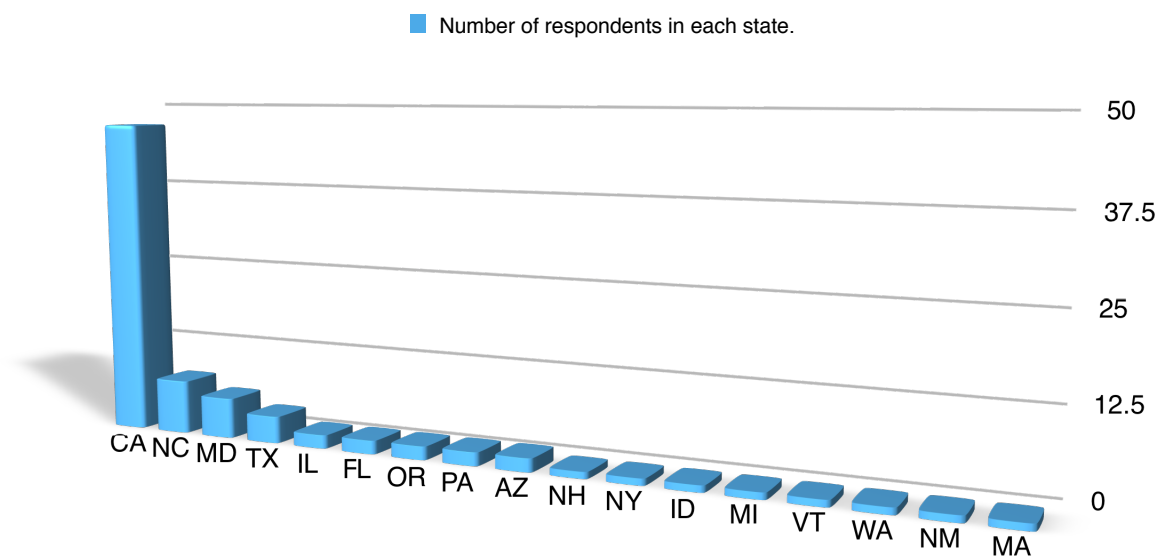
Question 36 asked all the respondents where their imaging center or private practice is located and 82% answered the question. There were a total of 17 different states represented with various numbers of respondents from each of those states. California had by far the most responses at 47 followed by North Carolina with 8 and Maryland with 6, rounding out the top three (Figure 14). The final question of the survey, number 37, asked respondents to indicate the age of

the owner of the facility and 79% answered the question. The ages ranged from 31 to 70 with a mean of 53 and both a median and mode of 54.

**Figure 13.** Please indicate what percent of patients pay with each payment type for scans taken on internal patients.



**Figure 14.** Where is your facility located?





## **STATISTICS**

### **Multivariate Analysis**

The objective of the analysis was to determine if there are differences in the interpretation, usage, or cost of CBCT scans based on the demographics of the facility or practitioner operating the facility. The dependent variables were: 1) percent interpreted, 2) usage, 3) cost, and 4) form of payment. These variables correspond with the categories that we defined at the beginning of the study: interpretation patterns, acquisition and utilization patterns, and reimbursement patterns, respectively. The independent variables were: 1) specialty, 2) location, 3) age, and 4) level of training.

First, the dependent variables cost and form of payment were compared to all the independent variables. For specialization, Endodontics was used as the standard due to having the largest number of responses. The analysis determined that the only independent variable which had enough evidence to establish a connection with either cost or form of payment was “specialty”. When looking at form of payment versus specialty, general dentists had a an estimate regression coefficient of -2.3 at a p-value of 0.00027 which is less than the significance level ( $\alpha$ ) = 0.05 (Table 3). Albeit three of the remaining four specialties had negative estimates, their p-values were much larger than the significance level of 0.05 (Table 3). This suggests that being a private practitioner with no specialization has an inverse and significant effect on form of payment. Furthermore, less than 50% of general dentist’s patients are more likely to pay for

**Table 3.** *Multivariate analysis of effect of specialization on form of payment.*

	Estimate	P-Value
<b>OMFS</b>	-0.7732	0.366444
<b>Orthodontics</b>	-0.7732	0.543759
<b>Periodontics</b>	0.3254	0.783259
<b>Prosthodontics</b>	-17.4379	0.990440
<b>General</b>	-2.2992	0.000271

CBCT scans with cash. Comparing cost versus specialty, general dentists had a an estimate regression coefficient of -90.78 at a p-value of 0.0108 which is less than the significance level ( $\alpha$ ) = 0.05 (Table 4). The estimate for general dentists was much greater than all other specialties which also had p-values much larger than the significance level of 0.05 (Table 4). Therefore, being a private practitioner with no specialization has a negative and significant effect on cost and the scans are more likely to be less expensive. The one prosthodontic respondent did not answer the question about cost and was therefore not included. The multivariate analysis demonstrated that none of our independent variables had any effect on percent of CBCT scans interpreted. In addition, we were not able to find any useful associations between the dependent variable “usage” and our independent variables.

**Table 4.** *Multivariate analysis of effect of specialization on cost.*

	Estimate	P-Value
OMFS	-43.06	0.3529
Orthodontics	-24.81	0.7100
Periodontics	-27.86	0.5471
General	-90.78	0.0108

## T-Test

None of the independent variables show a meaningful connection to interpretation patterns. Therefore, to further analyze the interpretation patterns, specific questions are compared. Question 18 which asked, “What percent of the CBCT scans taken for referring providers are interpreted?” was analyzed using a two sample t-test. The two groups were: acquisition only, and acquisition and interpretation which were taken from question 16. The test statistic was -2.415, the degrees-of-freedom were 12.868, and the p-value was 0.0314 which is less than the significance level ( $\alpha$ ) = 0.05, suggesting that there is a significant difference in the percent of scans interpreted between the two groups (Table 5).

**Table 5.** *Two Sample t-test comparing interpretation between practices which accept referrals for acquisition only and those which accept referrals for acquisition and interpretation.*

	T-Value	df	P-Value
Test statistic	-2.4145	12.868	0.0314

Not surprisingly, the acquisition and interpretation group are much more likely to have the scans interpreted while the acquisition only group is more inclined to defer to the referring provider. Questions 18 and 27 were also compared using a two sample t-test and the test statistic was -5.431, the degrees-of-freedom were 91.91, and the p-value was  $4.552 \times 10^{-7}$  which is much less than the significance level ( $\alpha$ ) = 0.05 (Table 6). Therefore, there is a significant difference between the percent of scans interpreted depending if they are internal or external patients, and internal scans are much more likely to be interpreted.

**Table 6.** *Two Sample t-test comparing the percent of scans interpreted between internal and external patients.*

	T-Value	df	P-Value
<b>Test statistic</b>	-5.431	91.91	$4.55 \times 10^{-7}$

## DISCUSSION

The objective of this study was to better understand the use of CBCT imaging in private practice including interpretation and reimbursement trends through a digital survey. The motivation for conducting this study is that CBCT technology has been around for over a decade and the literature currently contains very little information on its usage, interpretation trends and cost. This information is invaluable in guiding the future direction of the OMFR specialty, improving patient outcomes, and affecting change in insurance billing and reimbursement.

We hypothesized that “CBCT machines are being inappropriately used and infrequently associated with a formal radiological report.” When asked about CBCT indications for internal patients on question 26, 10% of Endodontists indicated that implant treatment planning was either the number one or two most common indication. On the surface this could appear as an inappropriate use; however, for the past several years implant dentistry has become more incorporated into the Endodontic training curriculum as a way to expand the discipline.<sup>16</sup> Furthermore, General dentists, Oral and Maxillofacial Surgeons, and Periodontists all denote that for scans acquired on both internal and external patients, implant treatment planning is by far the most common indication. Additionally, for those endodontic and orthodontic practices that accept outside referrals, implant treatment planning is either the second or first, respectively, most common indication for scans acquired on external patients. Imaging centers

also designate implant treatment planning as the most common indication.

These results imply that practitioners are using the CBCT machines appropriately because The Academy of Osseointegration (AO) and the AAOMR have both recently concluded that CBCT fulfills the requirements to be considered a standard of care and that all dental implants should be planned with a CBCT scan.<sup>17,18</sup> Therefore, based on the significant clinical advantage that a CBCT scan provides and medicolegal considerations, it is not surprising that implant treatment planning is the most common indication for CBCT scans.

Orthodontic practices also appear to be utilizing CBCT machines appropriately. For external scans, implant treatment planning, impacted teeth evaluation, and TMJ evaluation were equal at 25% followed by orthodontic treatment planning and root canal evaluation at 12.5%. However, for internal patients orthodontic treatment planning was 50%, impacted teeth evaluation 37.5%, and TMJ evaluation at 12.5%. It is important to note that three out of the four orthodontists did in fact rank implant treatment planning either fourth, sixth, or seventh out of nine. This is important because orthodontists place temporary anchorage devices (TADs) or mini implants to aid in tooth movement, and likely grouped them with implant treatment planning. Supporting that notion, a recent study by Landin et al found that CBCT provides a much more accurate assessment of the anatomy and leads to less unfavorable outcomes compared to two-dimensional imaging.<sup>19</sup> When taken together, the results are expected because we see that the indications are the same for both external and internal scans, except for the addition of implant treatment planning and root canal

evaluation for referred patients. Implant treatment planning is expected to be a high referral indication for the reasons listed in the previous analysis and orthodontic treatment planning and root canal evaluation are expected to be low because Orthodontists and Endodontists are more likely to own a CBCT machine themselves. The American Academy of Oral and Maxillofacial Radiology published a position statement in 2013 which outlines the uses of CBCT to enhance orthodontic treatment, but makes clear the responsibility of the provider to use CBCT judiciously.<sup>20</sup> Two professors in the Department of Orthodontics and Pediatric Dentistry at the University of Michigan echoed the same sentiment in their 2015 article entitled: “CBCT in orthodontics: assessment of treatment outcomes and indications for its use.”<sup>21</sup> The data of this study and the literature complement each other in demonstrating the appropriate use of the technology.

As for radiology reports, the results show that scans acquired in private practice and imaging centers have great variability in the percent interpreted and how often a formal radiological report is added to patient’s record. The respondents from imaging centers, private practices that accept referrals and are acting as *de facto* “imaging centers,” and private practices which don’t accept referrals were asked separately to indicate if a formal radiology report is added the patient’s record. For the purposes of this discussion, the one respondent under “imaging centers” who indicated that all scans were interpreted and a report was added the patient’s record was excluded. The reason for exclusion was that respondent is an OMFR, working in an academic setting, and is expected to interpret and generate a report for all the scans acquired. That said,

the remaining imaging centers indicate interpretation of scans are upon request and anywhere from 15 to 60 percent of the scans are interpreted; additionally, when interpreted, a formal report is always added to the patient's record. Cone beam CT scans acquired in private practices which accept referrals are interpreted on average 28% of the time. When asked how often a formal report is added to the patient's record, 29% stated a report is added, 24% state that no report is added and the majority, 47%, state that it's the responsibility of the referring provider. Looking more closely at the data confirms that multiple people state that the scans are interpreted, but no report is added to the patient's record and vice versa. For example, several respondents who indicate that they accept referrals, state that either zero or some percent are interpreted, and then follow up with either "yes" a report is added or "no" it's not added, respectively. A plausible explanation for this is that the respondents are not being truthful when asked the percentage of scans that are interpreted. Another limitation is the way the question about reports was asked, which did not specifically state "When interpreted, how often is a report added to the patient's record." The results cause us to ask, "why would someone interpret a scan, and not add the findings to the patient's record, or vice versa?" The private practice *de facto* imaging center also seems much more inclined to defer to the referring provider for interpretation and managing the patient's record. On the contrary, imaging centers facilitate the interpretation upon request from the provider as well as the addition of the report to the patient's record. Last, private practices that do not accept outside referrals state on average that 70% of scans acquired on internal



patients are interpreted, and a large majority, 64%, add a report to the patient's record. However, we are still left wondering why someone would take the time to interpret a scan and not add the findings to the patient's record, and the same limitation in the question wording applies. This point is emphasized by a 2010 article in which Dr. Friedland emphasizes that acquiring scans, and not including a report in the patient's record exposes the provider to potential legal ramifications in the future.<sup>9</sup> The AAOMR position paper on acquiring and interpreting CBCT scans states: "Just as a pathology report accompanies a biopsy, an imaging report must accompany a CBCT scan."<sup>25</sup> Therefore, the interpretation of CBCT scans and the generation of formal radiological reports remains somewhat unclear.

The next hypothesis of this study was that CBCT machines are being used as a screening device and a majority of scans are paid for out-of-pocket by the patient. One of the limitations of the survey is that we were unable to decipher whether or not respondents are using the CBCT machines as a screening device. Receiving honest answers to questions related to screening is challenging because of the almost universal knowledge that screening of asymptomatic patients is an incorrect use of the technology which exposes the patient to unnecessary ionizing radiation.<sup>26</sup>

The results show that a majority of scans are paid for out-of-pocket by the patient, regardless of whether it's an internal patient or referred from an outside provider. There were two questions which asked about the type of payment patient's used to pay for scans: one for private practices that accept referrals and

one for both imaging centers and private practices that don't accept referrals. The overwhelming majority of practices which accept outside referrals state that greater than 90% of patients pay with cash for CBCT scans. Complementing this result, less than 10% of patients pay with private insurance for CBCT scans. Five respondents indicate that 50% pay with cash and 50% pay with private insurance with the rest scattered throughout the ranges. Even though we expected the majority of patients pay with cash, it is surprising that the number of patients paying with insurance is so low considering the CDT codes that were developed by the ADA and insurance companies.<sup>11</sup> Additionally, our statistical analysis found that the providers who have less than 50% of their patients paying with cash are more likely to be general dentists. Four respondents indicate that patients pay with "other:" two at 100% and two at 10%. One logical reason is that these respondents incorporate the cost of the scan into a larger procedure, such as root canal treatment, dental implant placement, or orthodontic treatment. No respondents chose Medicaid/Medicare. This may be due to the Medicare requirement that a CBCT facility be certified by the Intersocietal Accreditation Commission (IAC). A similar pattern is observed for both imaging centers and private practices which do not accept referrals. However, there is slightly more variability with more responses throughout the remaining percentage categories. Once more, four respondents indicate that some percent pay with "other," and we made the same conjecture as with those practices that accept referrals. Despite the similarity in the number of "other" responses, the percentages were much smaller and no one stated 100% were paid for by "other." Interestingly, one

respondent indicates that 70% pay with Medicaid/Medicare. The respondent is a private practice general dentist from California who does not accept outside referrals. This is significant because the historical trend in healthcare is programs like Medicaid and Medicare lead the way for reimbursement of new procedures or technologies with private companies following suit.<sup>3</sup> In addition, as it relates to the “standard of care,” the decision to cover a procedure by a third party payer is more significant than denying coverage.<sup>3</sup> Therefore, observing both government and private companies beginning to cover CBCT scans is a positive trend towards this technology becoming more accepted as the standard of care and increasing patient access.

The last hypothesis of this study was many CBCT machines are operated by an individual who is not qualified. The survey did not specifically ask for who is actually pushing the button during acquisition, but this can be reinterpreted as the scans after acquisition are being managed by someone who is not qualified. In other words, the person who is interpreting the scans is not qualified. The results reveal that for both external and internal scans, when scans are interpreted, the owner or another provider within the practice is most likely the person interpreting. Looking at the credentials of the providers who are interpreting external scans shows that close to 70% received training from either the manufacturer or a generic CE course. The next largest group was “unknown” at 17% and most of these respondents chose “outside dental practitioner” on the previous question, validating the response. Examining the credentials of the providers who are interpreting internal scans shows a similar, but even more

dramatic pattern with 74% trained by either the manufacturer or a generic CE course. Therefore, the results support our hypothesis that the scans are interpreted by an unqualified person.

The topic of CBCT interpretation as it relates to who is qualified to interpret and the liability associated with interpretation are constant and dynamic points of discussion amongst the specialties. At the outset, we described the process of a new technology being ahead of laws and regulations and how CBCT was no exception. After over a decade of use, it is clear that CBCT meets the standard of care for both implant treatment planning and complex orthodontics.<sup>17,18,22</sup> However, the standard of care for the interpretation of CBCT volumes remains unclear. In a 2007 article, Dr. James Geist, who is an OMFR, states that scans should be interpreted by a “qualified person” and points out that OMFRs are indeed qualified by education and examination to do exactly that.<sup>12</sup> Unfortunately, the term “qualified person” has not been adequately defined in the medicolegal sense. The editor-in-chief of the American Journal of Orthodontics and Dentofacial Orthopedics, Dr. David Turpin, opines that aside from referring CBCT scans to OMFRs, another way to become “cone-beam fluent” is to receive training through the one of the already established dental specialty residencies or continuing education courses taught by OMFRs.<sup>13</sup> Interestingly, there are two levels of courses offered by the AAOMR which provide a basic level of competency; unfortunately, the results of this study show that very few providers take advantage of these courses. Dean and program director of orthodontics at Jacksonville University, Dr. Larry Jerrold, conducted a study in which he asked

several dentists and dental specialists, who also hold law degrees, their opinion on CBCT liability.<sup>27</sup> The general consensus is that at a minimum, any provider who acquires CBCT scans is liable for not recognizing abnormalities or pathologies on any cuts used for the clinical indication, but were mixed as to whether that applied to the entire scan.<sup>27</sup> That said, several respondents specifically stated that the provider interpreting is held to the same standard as an OMFR.<sup>27</sup> That sentiment is echoed in the 2008 AAOMR executive opinion statement on performing and interpreting diagnostic cone beam computed tomography.<sup>25</sup> In a letter-to-the-editor response to Dr. Jerrold's article, orthodontic Professor Dr. Mladen Kuftinec references an article by Cha et al which points out the number of incidental findings that might be missed by a unqualified person.<sup>4,15</sup> He concludes with a common sense approach, "if you take a scan, you should be able to read it," and if not you should refer to a qualified OMFR.<sup>4</sup> In conclusion, the results clearly demonstrate that a majority of CBCT scans are interpreted by a provider within the practice acquiring them, are unqualified by the definition of the providers themselves, and are left open to potential litigation.

## CONCLUSIONS

As demonstrated throughout this study, there is a great need and opportunity for OMFRs to work together with other general dentists and dental specialists to improve patient care and outcomes. This is supported by the large number of CBCT scans which are uninterpreted or interpreted without a formal radiology report added to the patient's record. In addition, this study demonstrated that often an unqualified person is interpreting the scans which can lead to an increase in patient morbidity. Unfortunately, despite the development of CDT codes for CBCT acquisition and interpretation, few insurance companies are currently reimbursing for these services. However, it does appear that the process of reimbursement is in the early stages and will likely grow in the coming years.

One question to consider, "Is the current number of OMFRs in the United States adequate to meet the demands of the dental marketplace?" This is particularly meaningful if the law progresses towards a mandate to have every CBCT scan accompanied by a report, similar to medicine. I surmise that the current number is dramatically lower than the number of OMFRs that will be needed in the coming years. As more and more dental specialists graduate with an improved knowledge of CBCT technology and awareness of the OMFR specialty, the demand for OMFRs will increase concurrently. The demand is compounded by an increased awareness of medicolegal concerns in the litigious society we live in. Beyond that, the University of Minnesota's Center for

Magnetic Resonance Research in the Department of Radiology is developing Sweep Imaging with Fourier Transformation (SWIFT) MRI technology which can image both soft and hard tissue.<sup>1,28</sup> If successful, this will allow ionizing-free imaging for diagnosis and treatment planning. Even more than CBCT, it will take many years before this technology will be taught even on a basic level in the dental curriculum and OMFRs will be in a great position to facilitate its use in dentistry. Therefore, the onus is on the OMFR specialty to market and reach out to other dental specialties while at the same time ensuring there are adequate numbers of OMFRs to meet the future demand.

## **FUTURE DIRECTIONS**

Now that there is a better understanding of usage, cost, and reimbursement trends, it would be interesting to explore how the cost of radiology reports is handled. Specifically, if the cost is bundled into the cost of the CBCT scan or other procedure. Also, whether or not the providers are using any of the CDT codes for interpretation and are being reimbursed for them. This is pertinent considering the extremely low number of respondents who stated that patients pay with private insurance.

Another study that would be interesting is specifically exploring those OMFRs in private practice to find out more about what a typical day looks like, number of scans read, and salary. This information is vital to informing people interested in becoming OMFRs about opportunities. Invariably, today's graduates shoulder a heavy burden of debt and need assurance that they will be able to sustain a private practice if they choose that route. Additionally, exploring the types and numbers of referrals that OMFRs receive would be valuable to compare to the data from this study. This information could provide a clearer picture of the CBCT landscape in dentistry.



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## APPENDIX

### The Use of Cone Beam in Private Dental Practices in the United States: Cost and Reporting Patterns

#### 1. Welcome to My Survey

Dear Doctor:

My name is Andrew Pakchoian, and I'm currently a second year Oral and Maxillofacial Radiology resident at the University of Connecticut. I'm sending you this letter to inform you of a survey study that I'm currently conducting and would seek your participation. The objectives of the survey are: to better understand the acquisition, interpretation, and reimbursement patterns of cone beam computed tomography in private practice. We believe this information will be important in establishing standards of care, insurance reimbursement, technology advancement, and integration into clinical practice. Ultimately, the practitioners who use the CBCT machines and, most importantly, the patients will benefit from the knowledge gained from this study.

This survey has approximately twenty questions. The survey takes about three minutes to complete and is totally anonymous. No personal information will be used in any publication that results from this study. Participation in the study is completely voluntary.

I really appreciate your participation in this research study to enhance the understanding of this technology. For any questions regarding the study, please feel free to e-mail me at: Pakchoian@uchc.edu

Sincerely,

Andrew J. Pakchoian, DDS

Oral and Maxillofacial Radiology Resident

Division of Oral and Maxillofacial Diagnostic Sciences University of Connecticut School of Dental Medicine Farmington, CT 06032

1. **Do you own and operate a CBCT machine?** Yes, No
2. **If yes, what type of facility is the CBCT machine in?** Private Practice, Imaging Center
3. **What are the credentials of the owner of the imaging center?** Dental Specialist, General Dentist, Dental Radiologic Technician Other, Other (please specify)
4. **If a specialist, which specialty?** Oral and Maxillofacial Surgery, Orthodontics, Prosthodontics, Periodontics, Endodontics, Pediatric Dentistry, Oral and Maxillofacial Radiology, Oral and Maxillofacial Pathology, Public Health Dentistry
5. **Approximately how many CBCT scans are acquired in your imaging center per year?**
6. **Please rank these CBCT indications from most to least common, for CBCT scans acquired in the imaging center. Drag and drop the following choices in order of preference or use the drop down list of numbers.** Implant treatment planning, Orthodontic treatment planning, Orthognathic treatment planning, Impacted teeth, Root canal evaluation, General pathology, Trauma, Sinus disease, TMJ evaluation
7. **How is interpretation of the scans acquired in your imaging center handled?** All scans are interpreted, Upon request from the referring provider, No scans are interpreted, Unknown/Responsibility of referring provider
8. **If scans are interpreted upon request, what percentage?**
9. **Is a radiologic report generated and added to the patient's record?** Yes, No, Unknown/Responsibility of referring provider
10. **When scans are interpreted, who is interpreting the scan?** Owner of the practice or another provider within the practice acquiring the scan, Outside Dental practitioner, Oral and Maxillofacial Radiologist (OMFR), Unknown
11. **What is the highest level of CBCT training the individual interpreting has received?** Training from manufacturer, Generic CE course, American Academy of Oral & Maxillofacial Radiology - Level 1 CBCT course, American Academy of Oral & Maxillofacial Radiology - Level II CBCT course, No specific training, Unknown

12. **What is the OMFR's affiliation?** Private reading service, Dental School, Unknown
13. **What are the credentials of the owner of the practice?** Dental Specialist, General Dentist, Dental Radiologic Technician, Other (please specify)
14. **If a specialist, which specialty?** Oral and Maxillofacial Surgery, Orthodontics, Prosthodontics, Periodontics, Endodontics, Pediatric Dentistry, Oral & Maxillofacial Radiology, Oral & Maxillofacial Pathology, Public Health Dentistry
15. **Approximately how many CBCT scans are acquired in your practice per year?**
16. **Do you accept referrals from outside providers?** CBCT acquisition only, CBCT acquisition and interpretation, CBCT Interpretation only, No referrals are accepted
17. **Please rank these CBCT indications from most to least common, for CBCT scans acquired for outside referrals. Drag and drop the following choices in order of preference or use the drop down list of numbers.** Implant treatment planning, Orthodontic treatment planning, Orthognathic treatment planning, Impacted teeth, Root canal evaluation, General pathology, Trauma, Sinus disease, TMJ evaluation
18. **What percent of the CBCT scans taken for referring providers are interpreted?**
19. **When a scan is evaluated for external providers, is the entire scan evaluated or just the area of interest?** Entire Scan, Area of interest, Unknown
20. **Is a radiologic report generated and added to the patient's record for CBCT scans of patients referred from outside providers?** Yes, No, Responsibility of referring provider/Unknown
21. **When external scans are interpreted, who is interpreting the scan?** Owner of the practice or another provider within the practice acquiring the scan. Outside Dental practitioner, Oral and Maxillofacial Radiologist (OMFR), Unknown
22. **What is the highest level of CBCT training the individual interpreting external scans has received?** Training from manufacturer, Generic CE course, American Academy of Oral & Maxillofacial Radiology - Level 1 CBCT course, American Academy of Oral & Maxillofacial Radiology - Level II CBCT course, No specific training, Unknown
23. **What is the OMFR's affiliation?** Private reading service, Dental School, Unknown
24. **Approximately how many hours of training?**
25. **Please indicate what percent of patients pay with each payment type for external referrals. Answers must add up to 100.** Patient self-pay (cash), Private insurance Medicaid/Medicare, Other, Unknown



**26. Please rank these CBCT indications from most to least common, for CBCT scans acquired for internal patients. Drag and drop the following choices in order of preference or use the drop down list of numbers.** Implant treatment planning, Orthodontic treatment planning, Orthognathic treatment planning, Impacted teeth, Root canal evaluation, General pathology, Trauma, Sinus disease, TMJ evaluation

**27. What percent of the CBCT scans acquired in your practice for internal patients are interpreted?**

**28. When a scan taken for internal patients is evaluated, is the entire scan evaluated or just the area of interest?** Entire scan, Area of interest

**29. Is a radiologic report generated and added to the patient's record?** Yes, No

**30. When internal scans are interpreted, who is interpreting the scan?** Owner of the practice or another provider within the practice, Outside Dental practitioner, Oral and Maxillofacial Radiologist (OMFR)

**31. What is the highest level of CBCT training the individual interpreting has received?** Training from manufacturer, Generic CE course, American Academy of Oral & Maxillofacial Radiology - Level 1 CBCT course, American Academy of Oral & Maxillofacial Radiology - Level II CBCT course, No specific training, Unknown

**32. What is the OMFR's affiliation?** Private reading service, Dental School, Unknown

**33. Approximately how many hours of training?**

**34. What is the approximate total patient cost, in dollars, of a CBCT scan in your facility?**

**35. Please indicate what percent of patients pay with each payment type for scans taken on internal patients. Answers must add up to 100.** Patient self-pay (cash), Private insurance Medicaid/Medicare, Other, Unknown

**36. Where is the facility located?** State/Province

**37. What is the age of the person who owns the facility?**

*Thank you for participating in the survey. Your responses have been received.*